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PATHWAYS TO CHANGE IN ONE-SESSION EXPOSURE WITH AND WITHOUT
COGNITIVE INTERVENTION: AN EXPLORATORY STUDY IN SPIDER PHOBIA.

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Abstract

It is well established that exposure therapy is an effective treatment for anxiety disorders. It is less clear, however, which mechanisms are crucial in explaining its success. In previous studies, cognitive change has been identified as a mediating variable. Several theorists have argued that the addition of cognitive interventions will, therefore, result in enhanced treatment effects. We tested this hypothesis by examining cognitive mediation of treatment in a purely behavioral versus a cognitive-behavioral exposure format. Thirty-one spider phobics were randomly assigned to either behavioral exposure or to exposure as a test for maladaptive cognitions (i.e., behavioral experiments). Both treatment formats showed large treatment effects and strong cognitive mediation of these effects. This indicates that, even when cognitions are not explicitly targeted, exposure effects are cognitively mediated. This challenges the idea that cognitions have to be explicitly challenged to elicit cognitive change in exposure treatment.

Keywords: spider phobia; exposure; cognitive mediation; behavioral experiment

1.1 Pathways to change in one-session exposure with and without cognitive intervention:

An exploratory study in spider phobia.

There is a consensus that cognitive processes are crucial in development and maintenance of anxiety disorders (Clark, 1999). Therefore, it seems plausible that changing maladaptive cognitions will change the severity of fear or anxiety symptoms. Indeed, several studies have shown that cognitive change mediates treatment outcome, in the sense that changes in maladaptive cognitions precede and explain reductions in social phobia (Hofmann, 2004; Smits, Rosenfield, McDonald, & Telch, 2006; Vögele et al., 2010), panic disorder (Hofmann et al., 2007) and agoraphobia (Vögele et al., 2010).

As a consequence, researchers and therapists generally agree that maladaptive cognitions should be changed during therapy. Furthermore, some authors argue that if the mechanism of change (i.e., change in cognitions) is directly targeted (i.e., through cognitive interventions), treatment effects will be larger (Clark, 1999; Rachman, 1997). Several empirical studies confirm that the use of cognitive interventions (slightly) enhances treatment outcome (Bryant et al., 2008; Clark et al., 2006; Mattick, Peters, & Clarke, 1989; McMillan & Lee, 2010; Salkovskis, Hackman, Wells, Gelder, & Clark, 2007). Other studies, by contrast, have not found enhanced treatment effects when cognitive interventions were added to a behavioral treatment (Feske & Chambless, 1995; Koch, Spates, & Himble, 2004; Whittal, Thordarson, & McLean, 2005).

We see several explanations for these inconsistent results. One possibility is that treatments with and without cognitive interventions entail different mechanisms of change which, however, lead to similar treatment effects. For example, it might be that addition of cognitive restructuring, depending on how it is implemented within treatment, lowers the threshold for subsequent exposure (with cognitive change preceding changes in behavior tendencies) or focuses attention on maladaptive cognitions during exposure (with exposure

functioning as an ‘experiment’ for certain cognitions). On the other hand, a purely behavioral treatment might primarily target behavioral tendencies such as avoidance, which in turn leads to cognitive change. In this line of reasoning, the measures that are used to index treatment success, as well as the timing of this measurement, can influence the treatment effects that are found.

Another possible explanation is that treatments both with and without cognitive interventions are successful because they target the crucial underlying cognitions to a similar extent. Differences between studies can then be explained through differences in within-study control of therapy time (Bryant et al., 2008) or in the way in which exposure is combined with cognitive interventions (administered together or separately). Also, there might be differences in the extent to which different anxiety disorders are suitable for exposure (e.g., exposure to spiders might get more to the core of spider phobia than exposure to physical sensations does in panic disorder) or cognitive interventions (e.g., a Socratic dialogue might be more effective in the context of PTSD than in the context of specific phobia).

In relation to this argument, Rauch and Foa (2006) stated that treatments need to activate the patient’s fear structure sufficiently to be successful. In our opinion, it is plausible that sufficiency, necessity, and relevance of different (e.g., cognitive and behavioral) treatment components in activating the fear structure differs between and within anxiety disorders (e.g., individual differences). Therefore, we believe that it is important to examine the impact of cognitive interventions in exposure treatment separately for different types of anxiety disorders.

Specific phobia is one type of anxiety disorder that is characterized both by maladaptive behavioral tendencies and maladaptive cognitions. Spider phobics strongly hold the belief that spiders are dangerous (Arntz, Lavy, van den Berg, & Rijsoort, 1993). Furthermore, research has indicated that these beliefs entail a high truth-value, in the sense

that they are not readily recognized as irrational or excessive (Jones & Menzies, 2000). These cognitions can also present themselves at an indirect, less accessible level of processing (Teachman, Gregg, & Woody, 2001; Teachman & Woody, 2003).

In the context of spider phobia or animal phobia in general, several studies have already compared behavioral treatment (exposure) to cognitive-behavioral treatment (exposure with cognitive interventions) (e.g., Arntz & Lavy, 1992; Koch et al., 2004). These studies found no differences between both versions of exposure, nor in general treatment effect, nor in the amount of cognitive change that was established (Koch et al., 2004). This suggests that the addition of cognitive interventions does not result in additional benefits.

A further question, however, is whether both versions of treatment are successful through addressing maladaptive cognitions. The aim of the present study is to investigate this question in the context of spider phobia. Spider phobia is a common type of specific phobia (e.g., Stinson et al., 2007) with a high treatment response to exposure in various formats (e.g. Koch, Spates, & Himle, 2004; Hellström & Öst, 1995; Öst, 1989, 1996).

A suitable method to directly compare purely behavior and cognitive-behavioral treatments is using behavioral experiments (see Longmore & Worrell, 2007; McMillan & Lee, 2010). In a behavioral experiment (BE), important (maladaptive) cognitions are identified and subjected to a (real-life) test, while alternative cognitions are constructed (Rouf, Fennell, Westbrook, Cooper, & Bennett-Levy, 2004). As such, BEs use exposure as a way to test and change cognitions. Through comparing a full behavioral experiment (i.e., with cognitive restructuring) with purely behavioral exposure, one can investigate whether behavioral experiments benefit from explicit cognitive interventions (Longmore & Worrell, 2007; McMillan & Lee, 2010).

In the present study, thirty-one spider phobics were randomly assigned to either a behavioral experiment condition (BE) or an exposure-only (EXP) condition. Both treatments

were delivered in a one-session treatment format. In the BE condition, exposure served to challenge maladaptive cognitions and to construct new, adaptive cognitions. In the EXP condition, exposure was performed without any form of cognitive intervention. Allocation to the BE and EXP conditions was randomized. All participants took part in three test sessions: a baseline session, a post-exposure session and a one-month follow-up session, on which we indexed participants' phobia severity as well as their phobia-related cognitions.

This is the first study that compares the level of cognitive mediation in purely behavioral versus cognitive-behavioral treatment of specific phobia. Previous studies have already demonstrated cognitive mediation of treatment in purely behavioral exposure formats and cognitive-behavioral treatments separately (Hofmann, 2004; Hofmann et al., 2007; Teachman, Marker, & Smith-Janik, 2008; Vögele et al., 2010). Therefore, we expect significant cognitive mediation of treatment outcome in both the BE and the EXP group. Still, as in the BE group, cognitions are directly targeted, we expect more cognitive mediation in the BE than in the EXP group. That is, although cognitive change might also be important in a purely behavioral exposure format (e.g., Vögele et al., 2010), other mediating variables such as the prevention/change in action tendencies (Wolitzky & Telch, 2009) might be more crucial in driving treatment outcome here.

1.2 Method

1.2.1 Participants

Participants were recruited via advertisements online at the website of Ghent University, via posters in the community, and via acquaintances. At the start of the baseline session, participants were screened for spider phobia with the Dutch version of the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; DiNardo, Brown, & Barlow, 1994; Dutch translation by Bouman, de Ruiter, & Hoogduin, 1995). Based on this interview, one

participant did not meet the criteria for spider phobia and was excluded from further participation.

Exclusion criteria for this study were: (a) prior pharmacological or psychological treatment for spider phobia; (b) use of psychopharmacological drugs; (c) duration of spider phobia less than one year; (d) diagnosis of a psychiatric disorder other than spider phobia; (e) presence of cardiac problems. These exclusion criteria were systematically assessed by the interviewer.

Thirty-one participants enrolled in this study. All participants were minimally 18 years of age and had not received previous treatment for spider phobia. Mean age of the sample was 21.65 ($SD = 5.33$). Most participants (87.1%) were female. The sample consisted mainly of single (87.1%) people who were still studying at university or a college of higher education (96.8%). Thirteen participants (41.3 %) were psychology students. There were no differences between the BE and EXP groups with regard to age, $t(29) = 1.39$, ns , gender, Fisher's Exact Test, $p = 1.00$, marital status, Fisher's Exact Test, $p = 1.00$, professional status, Fisher's Exact Test, $p = .48$, or the amount of psychology students, Fisher's Exact Test, $p = 1.00$.

1.2.2 Treatment Conditions

Individual exposure treatments were conducted by a master-level clinical psychologist specifically trained in exposure treatment. One-session treatments of maximally three hours (Zlomke & Davis, 2008) were used. Treatment protocols for both formats were based on Öst (1989), with small adaptations based on recent research (Cain, Blouin, & Barad, 2004; Tsao & Craske, 2000; see Craske & Mystkowski, 2006, for an overview). The protocol mainly involved in vivo exposure, combined with modeling by the therapist. Treatment protocols for both exposure formats were approved by the ethical committee of the psychology department of Ghent University.

Exposure was performed with different spiders (one medium-sized orb-web spider and one big-sized house spider). Participants were encouraged to increasingly approach the spider. This started from looking at the spider, enclosed in a glass jar, and progressed from catching the spider with a glass and a piece of cardboard, to touching the spider and letting it walk over their arm. Participants were encouraged to perform all steps, but could refrain from continuing at each point during therapy. All participants started with the smallest spider and were able to perform all steps with this spider. At the end of exposure, all participants were able to at least catch the largest spider with a fear level below 50 on a scale ranging from 0 (not fearful at all) to 100 (extremely fearful).

In the EXP group ($n = 16$), exposure was performed without any reference to cognitions or cognitive change. If participants spontaneously discussed their cognitions, these cognitions were not being further elaborated on. In the BE group ($n = 15$), exposure was used to establish cognitive change. Therefore, participants' maladaptive cognitions were identified and exposure served as a real-life test for the truth-value of these cognitions.

1.2.3 Measures

1.2.3.1 Primary measures.

1.2.3.1.1 Spider phobia. Spider phobia was assessed with two self-report measures. The Spider Phobia Questionnaire (SPQ; Klorman, Weerts, Hastings, Melamed, & Lang, 1974) consists of 31 items with a true-false response format. The Fear of Spiders Questionnaire (FSQ; Szymanski & O'Donohue, 1995) comprises 18 items which have to be scored on a 0-7 scale (0 = does not apply to me, 7 = applies very much to me). Both measures have high internal consistency and good test-retest stability. In addition, these questionnaires can adequately discriminate phobic from non-phobic populations and are sensitive to therapeutic change (Muris & Merckelbach, 1996).

1.2.3.1.2 Phobia-related cognitions. Spider- and self-related cognitions were indexed with a Thought Checklist (TC) that was specifically designed for this study¹. For 10 spider-related cognitions (e.g., “*The spider will attack me*”) and 14 self-related cognitions (e.g., “*I will faint*”), participants had to indicate how strongly they endorsed each cognition (belief, prediction) whenever they were thinking about a confrontation with a spider. Ratings were performed on a ten-point anchored rating scale ranging from 0 (= *not at all*) to 10 (= *very strongly*).

Item-based analyses were performed on the data from this scale, which was administered to all participants in this study at baseline, post-exposure, and at 1-month follow-up. Split-half reliability coefficients for the spider-related scale ranged from .70 to .80. For the self-related items, split-half reliability ranged from .88 to .89. Internal consistency was adequate for both scales (spider-related items .82 to .89; self-related items .91 to .93).

1.2.3.2 Secondary measures.

1.2.3.2.1 Behavioral measures. A Behavioral Approach Test (BAT) assessed to what extent participants dared to approach a medium-sized house spider. Participants were asked to perform eight steps, with each step approaching the spider more closely (de Jong, Vorage, & van den Hout, 2000; see Appendix 1). The closer one’s score approaches eight, the more approach behavior one demonstrates. Participants performed the BAT after exposure and at follow-up.

1.2.3.2.2 Questionnaires. Participants completed the Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996) and the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) after exposure and at follow-up.

1.2.3.2.3 Subjective ratings at baseline. All subjective ratings were completed on 0-10 anchored rating scales. Participants were asked to predict the amount of fear and coping

potential for the upcoming exposure session (0 = no fear at all/will not cope well at all; 10 = a lot of fear/will cope very well).

1.2.3.2.4 Subjective ratings before exposure. Right before exposure, participants were asked (1) how much arousal they experienced at that moment; and (2) how much arousal they expected to experience during exposure (0 = I feel no arousal at all; 10 = I feel extremely aroused) .

1.2.3.2.5 Subjective ratings after exposure. Immediately after exposure, all participants indicated 1) how much arousal they experienced at that moment and 2) how much arousal they had experienced during exposure. In addition, they were asked to indicate treatment intensity, treatment intrusiveness, treatment acceptability and the extent to which they would recommend this treatment to others. Scores closer to 10 represented higher intensity, intrusiveness, acceptability and recommendation.

1.2.3.2.6 Subjective reports at follow-up. Participants indicated to what extent they had exposed themselves to spiders since the exposure session (frequency and type of exposure).

1.2.4 Procedure

At the start of each session, participants completed written informed consent. During the baseline session, everyone who volunteered to participate in this study was fully assessed. At first, potential participants were presented with the SPQ and the FSQ. After this, spider phobia was assessed using the animal phobia section of the ADIS-IV-NL and the interviewer systematically assessed each of the exclusion criteria (see above). Subsequently, participants received psycho-education on fear and anxiety, the development of phobias and general information on exposure. Also, they received treatment instructions (cf. Öst, 1989). Participants were told that they would be assigned to one of two exposure treatments, and that both treatments were effective to reduce phobic fear. However, they were not given any

further details on the differences between treatments. At the end of the baseline session, participants completed subjective ratings on fear and coping and were handed the Thought Checklist to complete at home before the exposure session. Participants were randomly assigned to the EXP or the BE group through coin tossing.

Three to four weeks after the baseline session ($Mdn = 24$ days), participants completed the exposure session. Prior to exposure, participants completed subjective arousal ratings. After exposure, there was a one-hour test session. During this session, participants started with completing subjective ratings on arousal and treatment experience. After this, they were interviewed with the ADIS-IV-NL (animal phobia). Subsequently, they completed the Thought Checklist, FSQ and SPQ. Then, the BAT was performed. The test session ended with participants filling out the BDI and STAI.

The follow-up sessions were scheduled one month after the exposure session ($Mdn = 30$ days). This session started with a short interview on the amount of self-directed exposure since the exposure session. Apart from the subjective ratings, the follow-up session was identical to the post-exposure session.

1.2.5 Data analysis

We assessed short-term and sustained treatment effects for the SPQ and FSQ separately by performing 2 (Group: EXP, BE) \times 2 (Time: baseline, post-exposure/post-exposure, follow-up) mixed analyses of variance (ANOVA's) with group as a between-subjects variable and time as a repeated-measures variable. Bonferroni corrections were used to control for multiple comparisons ($\alpha < .017$). Cohen's d ($M_1 - M_2 / \sigma_{\text{pooled}}$) is reported as a measure of effect size.

Mediation analysis was performed using multilevel regression analyses (cf. Hofmann et al., 2007). Time served as the Level 1 unit, which was nested within participants (Level 2) (e.g., Kenny, Korchmaros, & Bolger, 2003). We performed separate analyses in which FSQ

and SPQ scores respectively served as dependent variables (Y). We examined the effect of time (X), a variable with three levels (baseline, post-exposure, and follow-up), on FSQ/SPQ. In both cases (effect of time on FSQ and SPQ), two regression analyses were performed to examine the mediating effect of both TC subscales (spider- and self-related cognitions).

(“Figure 1 about here”)

As shown in Table 1, reductions on both the FSQ/SPQ and on the spider- and self-related subscales of the TC were much larger from baseline to post-exposure than from post-exposure to follow up. Therefore, the assumption of a linear effect of time is not appropriate for the analysis of the present data, so in contrast with previous studies (e.g., Hofmann et al., 2007), dummy coding was used for the effect of time. As a result of this approach, different parameters emerge for mediation of post-exposure and follow-up reductions in SPQ/FSQ scores. These results are presented in Table 3 and Table 4.

As we expected that cognitive mediation in the BE group would be more pronounced than in the EXP group, the above described analyses were performed by modeling moderated mediation effects. We tested for the significance of mediated paths ($a \times b$) in each group using a Sobel test. In addition, the proportion of mediation (P_M ; Shrout & Bolger, 2002) was calculated for each of the mediation models. This value represents the proportion of the total effect that can be explained by the mediator. Approximate randomization tests (MacKinnon, 2008) were exploited to assess the difference in mediation effect between the EXP and BE group. This resampling technique was further used to check the robustness of the results derived from the Sobel test.

1.3 Results

1.3.1 Preliminary Analyses

1.3.1.1 Treatment characteristics and subjective ratings of treatment. Treatment characteristics and participants' ratings of these characteristics are presented in Table 2. There

were no between-group differences in treatment duration, which was maximally 180 minutes in both groups. With regard to subjective ratings, the groups differed in the amount of fear they expressed for the exposure session at the end of the baseline session. The BE group expressed a higher level of fear than the EXP group. However, there was no difference in the level of arousal that participants in the EXP and BE group experienced right before the start of exposure.

1.3.1.2 Approach behavior. A mixed 2 (Group) x 2 (Time: post-exposure, follow-up) ANOVA performed upon BAT approach behaviour yielded no significant effects, F 's < 1, indicating that there were no significant differences in approach behaviour between the groups either at post-exposure or at follow-up (see Table 1).

1.3.1.3 Self-directed exposure between exposure and follow-up. The EXP and BE groups showed similar amounts of self-directed exposure. In each group, three participants (18.8% and 20% respectively) did not do any self-directed exposure between the exposure and the follow-up session. In addition, each group contained six participants (37.5% and 40% respectively) who only looked at spiders. Furthermore, in the EXP group, seven participants (43.8%) caught or touched a spider, compared to six participants (40%) in the BE group, p 's > .97 (Fisher's exact test).

1.3.1.4 Depression and anxiety. As depicted in Table 1, there were no significant between-group differences on BDI or STAI scores. Within-group comparisons showed that there were no significant differences between the post-exposure and follow-up data of the BDI and the STAI-state scores for either of the groups, p 's > .17.

1.3.2 Treatment effects

1.3.2.1 Spider fear. There were no between-group differences in the fear reduction from baseline to post-exposure (p 's > .14), with a significant main effect of time on the SPQ, $F(1,29) = 149.89$, $p < .001$, $d = 2.23$, and the FSQ, $F(1,29) = 220.24$, $p < .001$, $d = 2.81$ (see

also Table 1). The same was true for the reduction from post-exposure to follow-up, p 's $> .89$ (analyses involving group), with a significant main effect of time for the FSQ, $F(1,29) = 10.19$, $p < .005$, $d = 0.42$, and a marginally significant effect for the SPQ, $F(1,29) = 4.20$, $p = .05$, $d = 0.30$.

1.3.2.2 Phobia-related cognitions. With regard to cognitive change, we performed 2 (Group) \times 2 (Time: baseline, post-exposure/post-exposure, follow-up) mixed multivariate analyses (MANOVA's) on spider- and self-related cognitions. The baseline versus post-exposure analysis yielded a significant main effect of time, $F(2,28) = 125.58$, $p < .001$ (see also Table 1). There were no significant main or interaction effects involving groups, p 's $> .14$. Univariate results indicated that there was a significant reduction in both self-related, $F(1,29) = 102.22$, $p < .001$, $d = 1.76$, and spider-related cognitions, $F(1,29) = 220.29$, $p < .001$, $d = 3.52$ (see Table 1). The 2 (Group) \times 2 (Time: post-exposure, follow-up) mixed MANOVA showed that there was further cognitive change from post-exposure to follow-up, $F(2,28) = 3.42$, $p < .05$. Univariate results showed that the reduction was not significant for the self-ratings, $F(1,29) = 2.79$, ns , nor for the spider-ratings separately, $F < 1$.

1.3.3 Cognitive Mediation of Treatment

As depicted in Tables 3 and 4, there was a significant effect of time on FSQ/SPQ (expressed by the coefficients c) in both the EXP and the BE group. The total effect of time did not differ between the groups. Similarly, time significantly decreased both subscales of the TC (expressed by the coefficients a) in both groups. Short-term mediation (post-exposure results, see Table 3) and longer term mediation (follow-up results, see Table 4) yielded very similar results (as expressed by $a \times b$ coefficients) for corresponding dependent variables, mediators and treatment groups. These results are a replication of the results of the ANOVA's that are reported in the previous paragraph (treatment effects).

To assess mediated effects, we used Bonferroni's correction for multiple testing (p 's < .006) at each time point separately. After this correction, the size of the mediated pathway ($a \times b$ coefficients) was significant in all cases for the BE group. That is, the effect of time on FSQ/SPQ scores was significantly mediated by changes in self- and spider-related cognitions, both at post-exposure and at follow-up.

(“Table 3 about here”)

(“Table 4 about here”)

Cognitive mediation was also significant for the EXP group, except for reductions in the SPQ that could not be explained significantly by changes in self-related cognitions, either at post-exposure or at follow-up, after applying the multiplicity correction. Although all mediated effects were numerically larger in the BE than in the EXP group, none of the mediated effects were significantly different between treatment groups (all p 's > .28).

1.4 Discussion

Exposure is an effective intervention for various types of anxiety disorders, including specific phobia (Wolitzky-Taylor et al., 2008). Although there has been ample research into the effectiveness of exposure with and without cognitive interventions, no previous studies have examined whether there is a comparable level of cognitive mediation of treatment in these two exposure formats. In the present study, a group of spider phobics were treated with either purely behavioral exposure (EXP group), or with full behavioral experiments (BE group) (McMillan & Lee, 2010). Treatment effects, the amount of cognitive change and cognitive mediation of treatment were investigated within and between groups.

In both groups, level of fear subsided substantially after treatment (c path). Also, there was a considerable decrease in phobia-related cognitions in both groups (a path). These findings are in accord with those of previous studies (Arntz & Lavy, 1992; Koch et al., 2004). Most importantly, however, both groups showed large cognitive mediation of treatment. In

both the BE and the EXP group, treatment effects at post-exposure and at follow-up could be significantly explained by changes in maladaptive cognitions. Although the mediation effects were numerically larger in the BE than in the EXP group, there still was strong cognitive mediation in the EXP group. This finding is in accord with the results of Vögele et al. (2010), who found cognitive mediation of purely behavioral exposure in agoraphobia and social phobia in a large sample of patients.

From a theoretical stance, the finding of strong cognitive mediation of treatment even in a small sample of patients corroborates Hofmann's (2008) statement that exposure itself is cognitively mediated. That is, behavioral exposure seems to provide the phobic individual with corrective experiences that are, *by themselves*, powerful enough to challenge the existing fear structure and to modify it into a more adaptive structure (Foa & Kozak, 1986). A possible clinical implication from this finding is that it might not be necessary to challenge cognitions during exposure treatment.

However, the present results also leave some space for favoring a cognitive approach to treatment. Although no statistically significant between group differences could be detected, mediation effects were consistently larger in the BE group. This suggests stronger cognitive mediation in the BE group. The finding of stronger cognitive mediation in the BE group can be explained by the fact that cognitions are explicitly challenged in the latter format, whereas in EXP, cognitive change is established indirectly through exposure itself. This explanation is in line with Clark et al. (2006), who suggested that treatment effects will be stronger if the crucial mechanisms which maintain anxiety (i.e., maladaptive cognitions) are targeted directly.

An alternative possibility, however, is that there is more than one crucial variable maintaining anxiety, and that EXP and BE target these underlying mechanisms to a different extent. For instance, it might be that fear reduction occurs mainly via the cognitive channel in

exposure with cognitive restructuring, and mainly through behavioural pathways in purely behavioural exposure. This explanation is in accordance with the emotional processing theory of Foa and Kozak (1986), which states that cognitive as well as physical/emotional and behavioral elements are important in the emergence, maintenance, as well as modification of pathological fear. However, it is impossible to draw any conclusions with regard to mediators other than cognitive mediators based on the present data. Future research could serve to identify other mediating variables in EXP and BE. Examining mediation serves as a good precedence for the investigation of mechanisms of change (Kazdin, 2007), knowledge of which can be fruitful in optimizing treatments and make them more efficient. For instance, if cognitive mediation is equally strong in EXP and BE, this would imply that purely behavioral exposure is the crucial element of treatment. In that case, purely behavioral treatments could be favored because they allow to concentrate more efforts in exposure itself, which could make the treatment more powerful.

It is also important to note that all interpretations of the present results should be regarded with caution, as none of the between-group differences actually reached significance. This could, however, be due to the small sample size. The small differences in mediation effects between the EXP and BE groups suggest that a large sample size would be required to detect between-group differences in treatment success. For example, to detect a 5-point difference in mediation by spider-related cognitions on the FSQ ($\alpha = 0.5$) with 80% power, a sample of at least 40 subjects per treatment group would be required (assuming a standard deviation equal to 8). Future research should follow up on the present findings by comparing larger treatment groups.

Another limitation of the present study is the lack of temporal precedence of the mediator in relation to treatment outcome (MacKinnon, Lockwood, Hofmann, West, & Sheets, 2002), which prevents straightforward claims with regard to the causality of the

effects. However, in the present design, repeated within-session registration of phobia-related cognitions can be regarded as delicate, as this may impede the purely behavioral nature of treatment in the EXP group. Another cautionary note relates to the use of a customized questionnaire (Thought Checklist; TC) to assess maladaptive thoughts in spider phobia. The use of a validated questionnaire, such as the Spider Belief Questionnaire (Arntz et al., 1993), could seem more appropriate. However, the latter questionnaire indexes participants' belief with regard to phobia-related statements, whereas our questionnaire assesses how strongly spider- and self-related thoughts come to participants' mind. This nuance may seem small, but our questionnaire might be better able to capture thoughts that participants consider as irrational themselves.

A last limitation concerns the sample of the present study. We focused on patients with spider phobia. As argued in the introduction, we believe that it is crucial that mechanisms of change are examined for each type of anxiety disorder separately. The fact that we examined cognitive mediation in spider phobia therefore limits the generalisability of the present findings.

In spite of these shortcomings, the current study provides preliminary evidence that fear reduction as a result of exposure is strongly mediated by cognitions, whether purely behavioral exposure is used, or whether exposure is used as a test for maladaptive cognitions. These findings are important, as this is the first study that explicitly compares cognitive mediation of treatment between a purely behavioral and a cognitive-behavioral exposure format. A next step in extending our knowledge of mechanisms of change with regard to exposure therapy is to replicate this study with a larger and more heterogeneous sample, and to identify other possible mediators of treatment which might explain the present differences between the BE and the EXP group.

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Acknowledgments

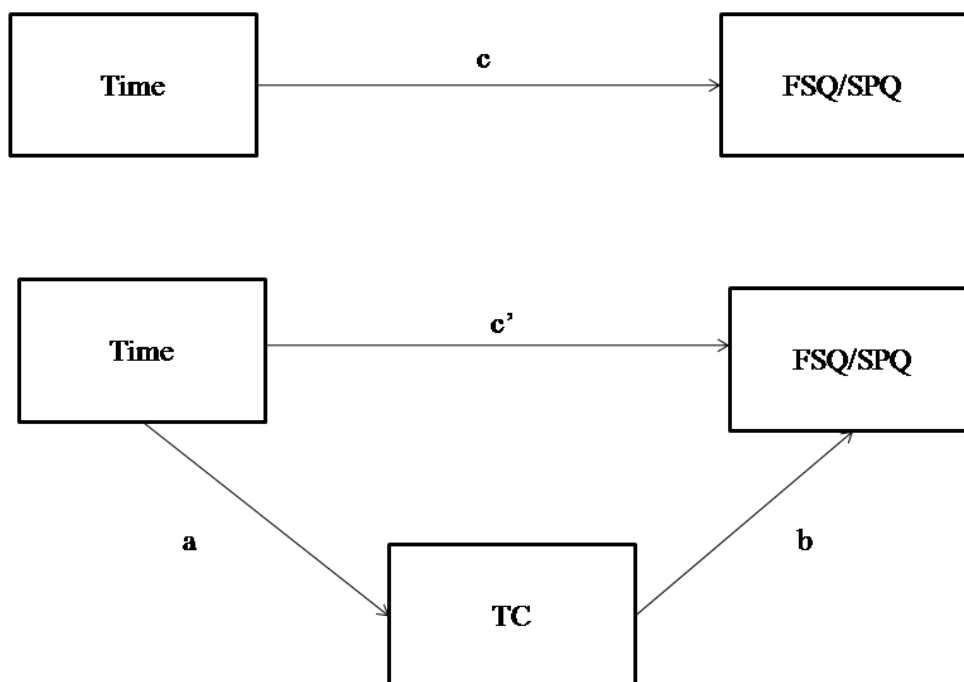
An Raes is a Research Assistant of the Research Foundation-Flanders (FWO), Belgium. The authors would like to thank Delphine Van Lierde and Iris Vollon for conducting the baseline, post-exposure and follow-up sessions.

Footnotes

¹ This checklist can be obtained upon request to the first author.

Figure 1. Paths c (predictor [time] to outcome [Fear of Spiders Questionnaire; FSQ/ Spider Phobia Questionnaire; SPQ]), a (predictor to mediator [Thought Checklist; TC]), b (mediator to outcome when controlling for the predictor), and c' (predictor to outcome when controlling for the mediator).

Figure 1.



Let i represent the individual participant and j represent the 3 time points. The hierarchical linear modeling approach used here was:

$$FSQ_{ij} = \text{intercept}_i + c_{1i} \times T_{1ij} + c_{2i} \times T_{2ij} + \epsilon_{1ij}$$

$$TC_{ij} = \text{intercept}_i + a_{1i} \times T_{1ij} + a_{2i} \times T_{2ij} + \epsilon_{2ij}$$

$$FSQ_{ij} = \text{intercept}_i + c_{1i}' \times T_{1ij} + c_{2i}' \times T_{2ij} + b_i \times TC_{ij} + \epsilon_{3ij};$$

where T_{1ij} (T_{2ij} respectively) equals 1 if time='Post Exposure' ('Follow-Up'), else 0.

The level 2 models for each level 1 parameter were:

$$\text{intercept}_i = \gamma_{00} + \gamma_{01} \times D_{1i} + \delta_i$$

$$c_{1i} = \gamma_{10} + \gamma_{11} \times D_{1i} \text{ (and similar for } c_{2i}, a_{1i}, a_{2i}, c_{1i}', c_{2i}' \text{ and } b_i);$$

where D_{1i} is a dummy variable for treatment group (1 if exposure, and 0 otherwise).

Note that upon inspection of the variance components, only a random intercept significantly contributed.

Table 1

Between-group comparisons for fear severity, fear-related cognitions and behavioral approach

Variable		EXP	BE	Test
SPQ	pre	20.94 (4.40)	22.00 (4.83)	$t < 1$
	post	11.75 (3.49)	11.00 (5.39)	$t < 1$
	follow-up	10.31 (4.42)	9.73 (5.22)	$t < 1$
FSQ	pre	87.75 (16.92)	94.27 (21.51)	$t < 1$
	post	38.94 (16.29)	34.33 (22.50)	$t < 1$
	follow-up	31.38 (18.57)	26.20 (17.30)	$t < 1$
TC_self-related	pre	3.47 (1.34)	4.58 (2.24)	1.68
	post	1.15 (1.00)	1.37 (1.34)	$t < 1$
	follow-up	1.04 (1.20)	1.08 (.90)	$t < 1$
TC_spider-related	pre	7.38 (1.26)	7.18 (1.63)	$t < 1$
	post	2.28 (1.26)	2.43 (1.52)	$t < 1$
	follow-up	2.18 (1.37)	2.23 (1.32)	$t < 1$
BAT_approach	post	7.75 (.45)	7.80 (.41)	$t < 1$
	follow-up	7.69 (.48)	7.80 (.41)	$t < 1$

Note. SPQ= Spider Phobia Questionnaire; FSQ = Fear of Spiders Questionnaire; BAT =

Behavioural Approach Task; TC = Thought Checklist

Table 2

Between-group treatment characteristics, subjective ratings of treatment and depression and anxiety scores

Variable	EXP	BE	Test
Treatment duration (in minutes)	162.81 (15.91)	166.00 (23.01)	$t < 1$
Fear for treatment (baseline)	71.88 (15.69)	86.00 (11.05)	2.88**
Coping potential (baseline)	56.25 (22.77)	42.67 (22.51)	1.67
Arousal before exposure	4.44 (1.93)	3.73 (1.67)	1.08
Predicted arousal before exposure	8.06 (1.12)	8.73 (1.16)	1.63
Arousal during exposure rated after session	7.75 (1.81)	8.00 (1.07)	$t < 1$
Arousal after exposure	2.38 (1.75)	1.87 (1.12)	$t < 1$
Treatment intensity	7.63 (2.03)	7.73 (1.33)	$t < 1$
Treatment intrusiveness	7.25 (1.91)	7.73 (1.58)	$t < 1$
Treatment Acceptability	9.50 (.89)	9.73 (.46)	$t < 1$
Recommendation	9.31 (.87)	9.67 (.62)	1.30
BDI _{exp}	6.00 (5.88)	5.20 (4.90)	$t < 1$
BDI _{fu}	6.25 (4.61)	4.60 (5.30)	$t < 1$
STAI-trait _{exp}	36.13 (8.64)	35.73 (8.86)	$t < 1$
STAI-trait _{fu}	34.63 (7.37)	37.47 (11.54)	$t < 1$
STAI-state _{exp}	35.67 (9.60)	30.27 (5.68)	1.85
STAI-state _{fu}	33.07 (6.75)	29.80 (8.27)	1.19

Note. BDI = Beck Depression Inventory; STAI-trait = State-Trait Anxiety Inventory (Trait Scale); STAI-state = State-Trait Anxiety Inventory (State Scale); exp= post-exposure session; fu = follow-up session.

** $p < .01$

Table 3

Path coefficients for mediation of treatment (FSQ/SPQ) by TC spider-related and self-related cognitions for the EXP and BE group at post-exposure

FSQ treatment effects						
Treatment	<i>c</i>	<i>c'</i>	<i>a</i>	<i>B</i>	<i>a x b</i>	<i>P_M</i>
TC_spider-related						
EXP	-48.8*****	-8.9	-5.1*****	7.8	-39.9*****	.81
BE	-59.9*****	-15.6	-4.7*****	9.5	-44.3*****	.73
TC_self-related						
EXP	-48.8*****	-15.4*****	-2.2*****	7.5	-16.7**	.34
BE	-59.9*****	-17.7*****	-3.2*****	7.0	-22.6*****	.37
SPQ treatment effects						
Treatment	<i>c</i>	<i>c'</i>	<i>a</i>	<i>B</i>	<i>a x b</i>	<i>P_M</i>
TC_spider-related						
EXP	-9.2*****	-2.8	-5.1*****	1.3	-6.4**	.62
BE	-11.0*****	-2.0	-4.7*****	1.9	-9.0*****	.82
TC_self-related						
EXP	-9.2*****	-6.2	-2.2*****	1.3	-3.0(*)	.32
BE	-11.0*****	-6.5	-3.2*****	1.4	-4.6***	.41

Note. FSQ = Fear of Spiders Questionnaire; SPQ = Spider Phobia Questionnaire; TC =

Thought Checklist; EXP = exposure; BE = behavioral experiment; *c* = effect relating time to FSQ/SPQ; *c'* = effect relating time to FSQ/SPQ when controlling for the mediator; *a* = effect relating time to the mediator; *b* = slope relating mediator to FSQ/SPQ, controlling for time; *a x b* = size of mediated pathway; *P_M* = the proportion of the relationship between time and FSQ/SPQ that is mediated by the specific mediator.

* $p < .05$; ** $p < \text{or} = .005$; *** $p < .001$; **** $p < .0001$.

(*) All effects with $p > .005$ are not significant after Bonferroni correction. Therefore, the significance levels are placed between brackets.

Table 4

Path coefficients for mediation of treatment (FSQ/SPQ) by TC spider-related and self-related cognitions for the EXP and BE group at follow-up

FSQ treatment effects						
Treatment	<i>C</i>	<i>c'</i>	<i>a</i>	<i>B</i>	<i>a x b</i>	<i>P_M</i>
TC_spider-related						
EXP	-56.4*****	-18.4	-4.9*****	7.8	-38.0*****	.67
BE	-68.1*****	-22.4	-4.8*****	9.5	-45.7*****	.67
TC_self-related						
EXP	-56.4*****	-37.6	-2.5*****	7.5	-18.8**	.33
BE	-68.1*****	-44.0	-3.4*****	7.0	-24.1*****	.35
SPQ treatment effects						
Treatment	<i>C</i>	<i>c'</i>	<i>a</i>	<i>B</i>	<i>a x b</i>	<i>P_M</i>
TC_spider-related						
EXP	-10.6*****	-4.5	-4.9*****	1.3	-6.1**	.57
BE	-12.3*****	-2.9	-4.8*****	1.9	-9.3*****	.76
TC_self-related						
EXP	-10.6*****	-7.3	-2.5*****	1.3	-3.3(*)	.31
BE	-12.3*****	-7.5	-3.4*****	1.4	-4.8**	.39

Note. FSQ = Fear of Spiders Questionnaire; SPQ = Spider Phobia Questionnaire; TC =

Thought Checklist; EXP = exposure; BE = behavioral experiment; *c* = effect relating time to FSQ/SPQ; *c'* = effect relating time to FSQ/SPQ when controlling for the mediator; *a* = effect relating time to the mediator; *b* = slope relating mediator to FSQ/SPQ, controlling for time; *a x b* = size of mediated pathway; *P_M* = the proportion of the relationship between time and FSQ/SPQ that is mediated by the specific mediator.

* $p < .05$; ** $p < \text{or} = .005$; *** $p < .001$; **** $p < .0001$

(*) All effects with $p > .005$ are not significant after Bonferroni correction. Therefore, the significance levels are placed between brackets.

Appendix 1: Behavioural Approach Task (BAT)

Necessities : - medium-sized spider in glass jar on a table

- plastic bowl

- pencil

Instruction: “To get an impression of how far you dare to approach a spider, I will ask you to perform a number of steps. You are free to refuse each step, you are not required to force yourself. But, you should do your very best so that we get an impression of how far you dare to go. Do you have any questions concerning this procedure?”

Step 1. Approach the spider as close as possible (spider in glass jar on the table).

Measure distance to the spider (+/-)cm.

Step 2.	Touch the jar. (> 10sec.)	Yes/No

Step 3.	Take up the jar. (> 10sec.)	Yes/No
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Step 4.	Open the jar. (> 10sec.)	Yes/No
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Step 5. Touch the spider (in the jar)

with the pencil	Yes/No
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Step 6. Put the spider in the bowl. Yes/No

Step 7. Touch the spider with a finger. Yes/No

Step 8. Let the spider walk over your hand. Yes/No

N.B. After each instruction, the assistant asks the participant whether he/she is willing to carry out the step or not. When a participant refuses, the assistant asks one time “Is it is really impossible for you to continue?”.